Mass resolution with Yasuyuki's thinner silicon tracker

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Changes to the thickness budget

Yasuyuki proposes to change from the SVX4 chip to the FPHX chip for reading out the silicon strip tracking layers. Since the FPHX chip requires much less cooling, the material budget can be reduced.

Yasuyuki's proposed thickness budget after switching the chips:

Layer	Radius	X0	
P0	2.5cm	1.3%	
P1	5.0cm	1.3%	
S0	8.0cm	2% radiation length	(For double layer S0a+S0b)
S1	32 cm	1.2%	(For double layer S1a+S1b)
S2	56 cm	1%	

I have made some estimates of the mass resolution, using this thickness budget, to try to see what the layer radii should be to achieve the needed 100 MeV Upsilon mass resolution.

Revised MIE configuration with reduced radii

Layer	Radius (cm)	cell size (cm x cm)	X0 (%)
P0	2.7	0.005 x 0.0425	1.3
P1	4.6	0.005 x 0.0425	1.3
S0a	7.5	0.0058 x 8.0	1.0
S0b	8.5	0.0240 x 8.0	1.0
S1a	29.0	0.0058 x 8.0	0.6
S1b	31.0	0.0240x 8.0	0.6
S2	60.0	0.0060 x 8.0	1.0

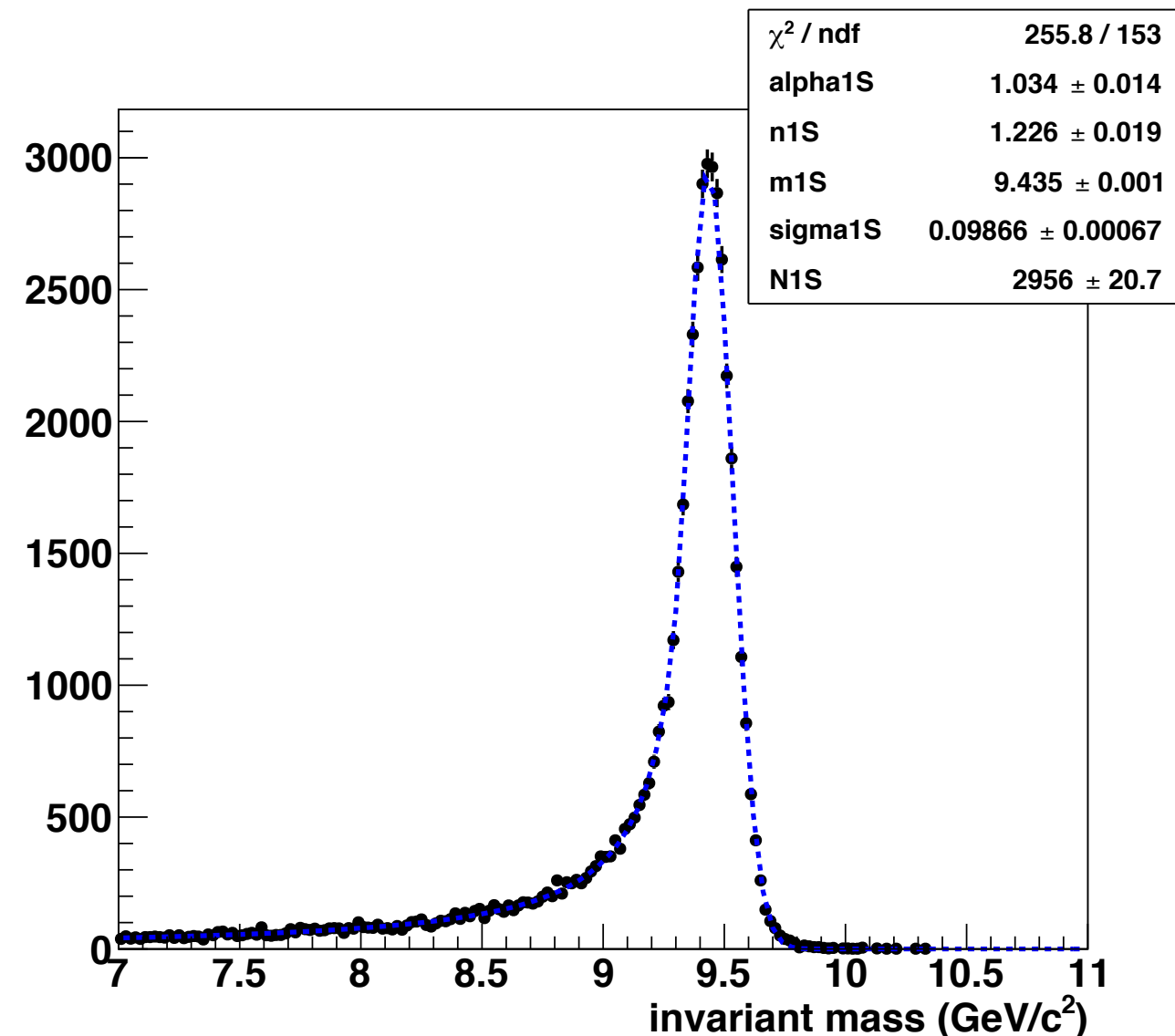mass resolution 110.9 MeV +/- 0.7 MeV

Need better resolution:
  Convert s0b and s1b to tracking layers - reduce their pitch to 60 microns

mass resolution 106.8 +/- 0.5 MeV

Go to Yasuyuki's preferred pitch of 58 microns, 9.6 mm length
Increase outer radius to 64 cm

Layer	Radius (cm)	cell size (cm x cm)	X0 (%)
P0	2.7	0.005 x 0.0425	1.3
P1	4.6	0.005 x 0.0425	1.3
S0a	7.5	0.0058 x 9.6	1.0
S0b	8.5	0.0058 x 9.6	1.0
S1a	35.0	0.0058 x 9.6	0.6
S1b	37.0	0.0058 x 9.6	0.6
S2	64.0	0.0060 x 9.6	1.0

mass resolution 98.7 MeV +/- 0.7 MeV

χ^2 / ndf	255.8 / 153
alpha1S	1.034 $\pm$ 0.014
n1S	1.226 $\pm$ 0.019
m1S	9.435 $\pm$ 0.001
sigma1S	0.09866 $\pm$ 0.00067
N1S	2956 $\pm$ 20.7

invariant mass (GeV/c^2)

ITS inner pixels instead of PHENIX pixels

Layer	Radius (cm)	cell size (cm x cm)	X0 (%)
P0	2.3	0.002 x 0.002	0.6
P1	3.2	0.002 x 0.002	0.6
P3	3.9	0.002 x 0.002	0.6
S0a	7.5	0.0058 x 9.6	1.0
S0b	8.5	0.0058 x 9.6	1.0
S1a	35.0	0.0058 x 9.6	0.6
S1b	37.0	0.0058 x 9.6	0.6
S2	64.0	0.0060 x 9.6	1.0

mass resolution 94.2 +/- 0.9 MeV

χ^2 / ndf	236 / 149
alpha1S	1.151 ± 0.023
n1S	1.444 ± 0.037
m1S	9.443 ± 0.001
sigma1S	0.09421 ± 0.00095
N1S	1384 ± 14.7

invariant mass (GeV/c^2)
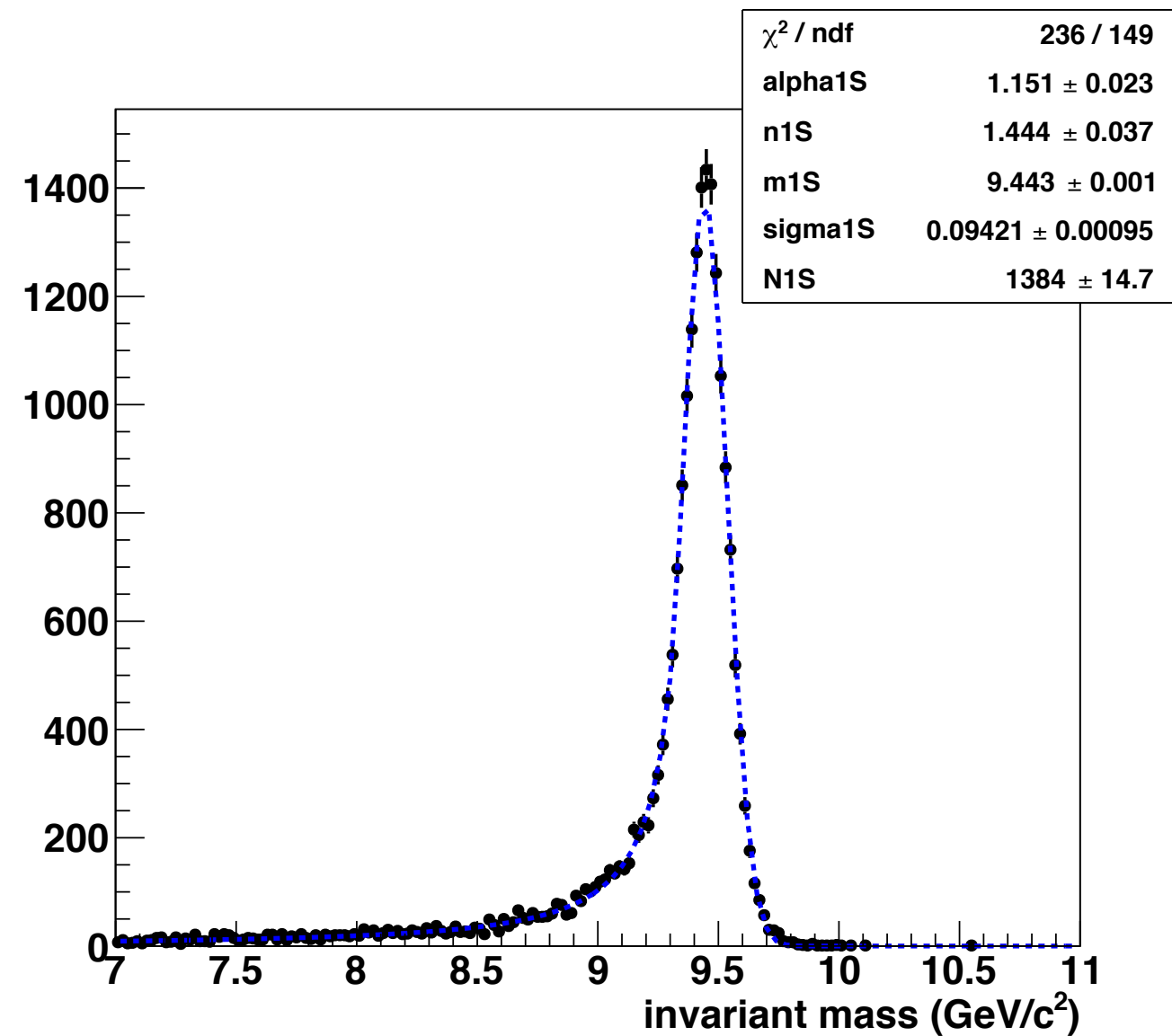
What next?

The pattern recognition layers have been replaced with tracking layers - need to understand the effect on pattern recognition.
   - Do we need to add pattern recognition layers?

Still need to go to realistic ladders

The new chip can still only readout a subset of the strips